EPA's Analysis of the Clear Skies Act



Presentation for the

National Energy Modeling System/Annual Energy Outlook

by

Sam Napolitano
Office of Air and Radiation, US EPA

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Clear Skies Act Is a Better Way to Do Business

- **Air quality has improved, but concerns persist.**
- **Power generation remains major source of three major pollutants: SO_2, NO_x, and mercury.**
- **Clean Air Act provides authority. However:**
  - **The path is complex, burdensome and uncertain**
  - **Aimed at direct control with limited flexibility**
- **Clear Skies' provides a better path to clean air.**
  - **Based on proven cap and trade model for Acid Rain**
  - **Flexible, cost-effective, certain, and mandatory**

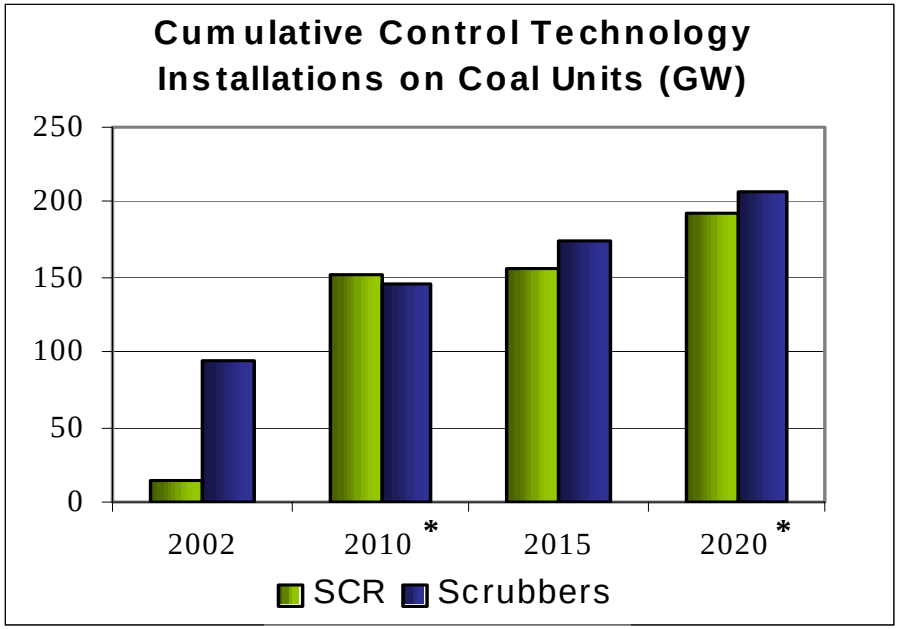
EPA completed analysis for the following results last year for the Clear Skies Act of 2002. The 2003 bill is very similar to last year. Results are measured against a base (reference) case covering EPA and State final regulatory actions and does not speculate on further regulatory actions. This has been the standard approach to this type of analysis since 1996.

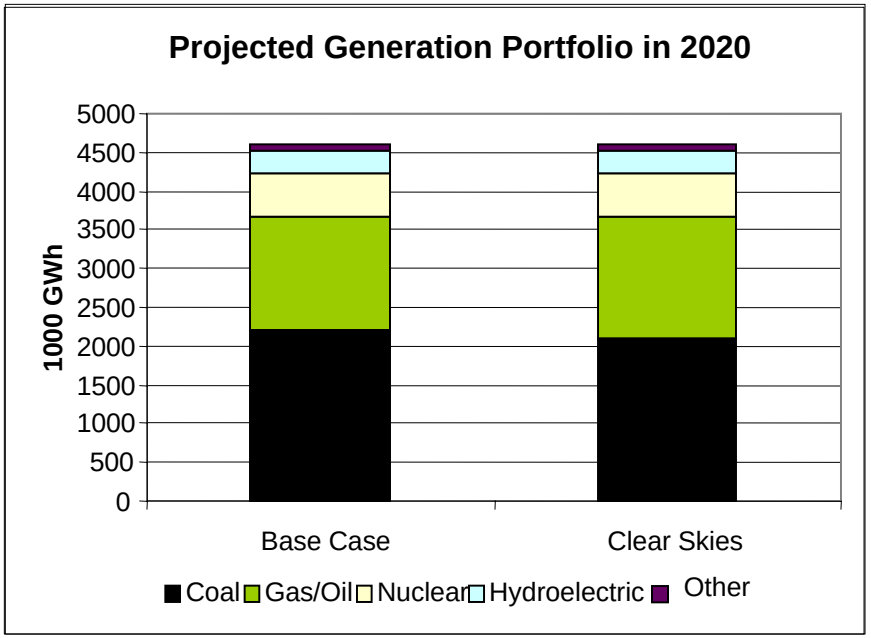
Clear Skies' Emissions Caps and Timing

	Current Emissions	Phase 1 Cap	Phase 2 Cap	Projected Emission Reductions
SO_2 (tons)	11 million	4.5 million (2010)	3 million (2018)	73%
NO_x (tons)	5 million	2.1 million (2008)	1.7 million (2018)	67%
Mercury (tons)	48	26 (2010)	15 (2018)	69%

Control Technology and Generation Portfolio

- **Caps and timing allow for steady implementation**
- **Significant pollution control additions occur**
- **Generation portfolio does not dramatically change**

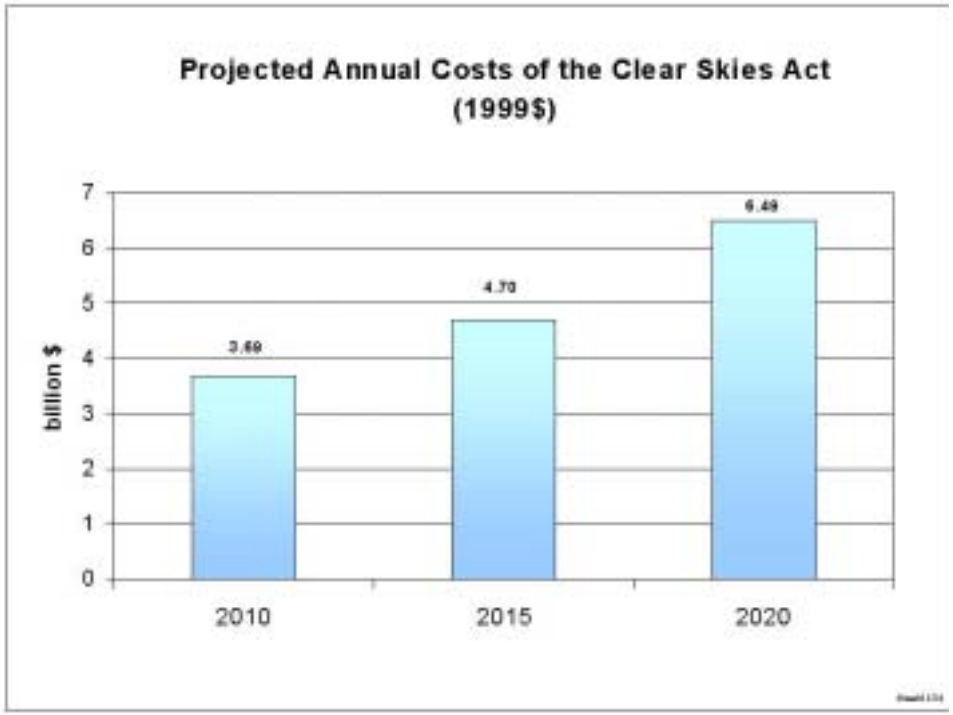


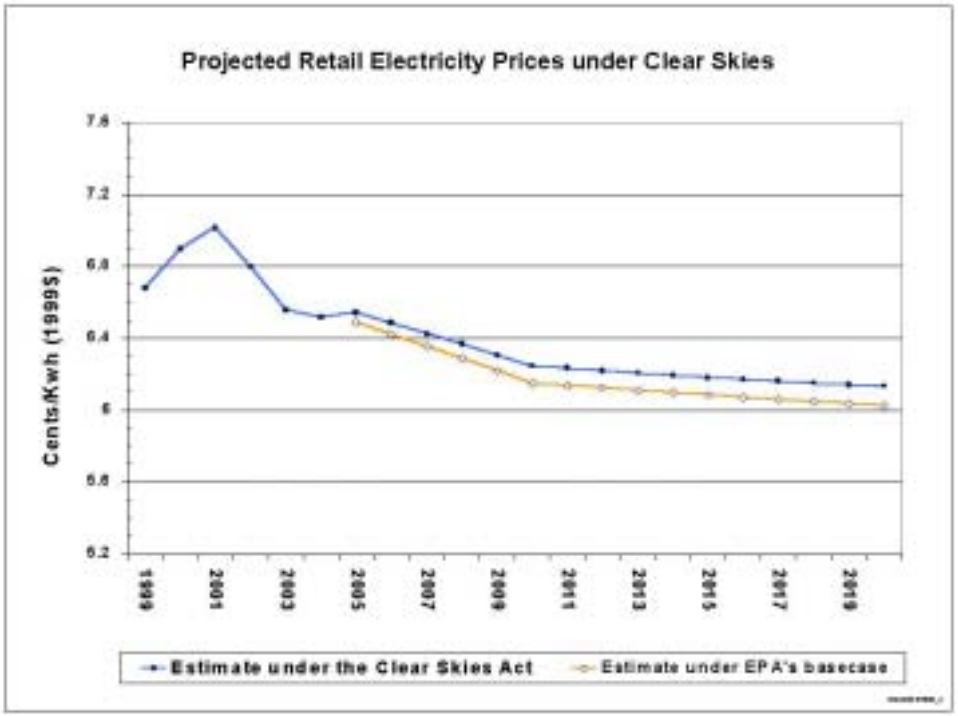


•Note that in the base case, there are about 102 GWs of Scrubbers and 94 GWs of SCR capacity in 2010 and that grows to 110 GWs and 103 GW, respectively, in 2020.

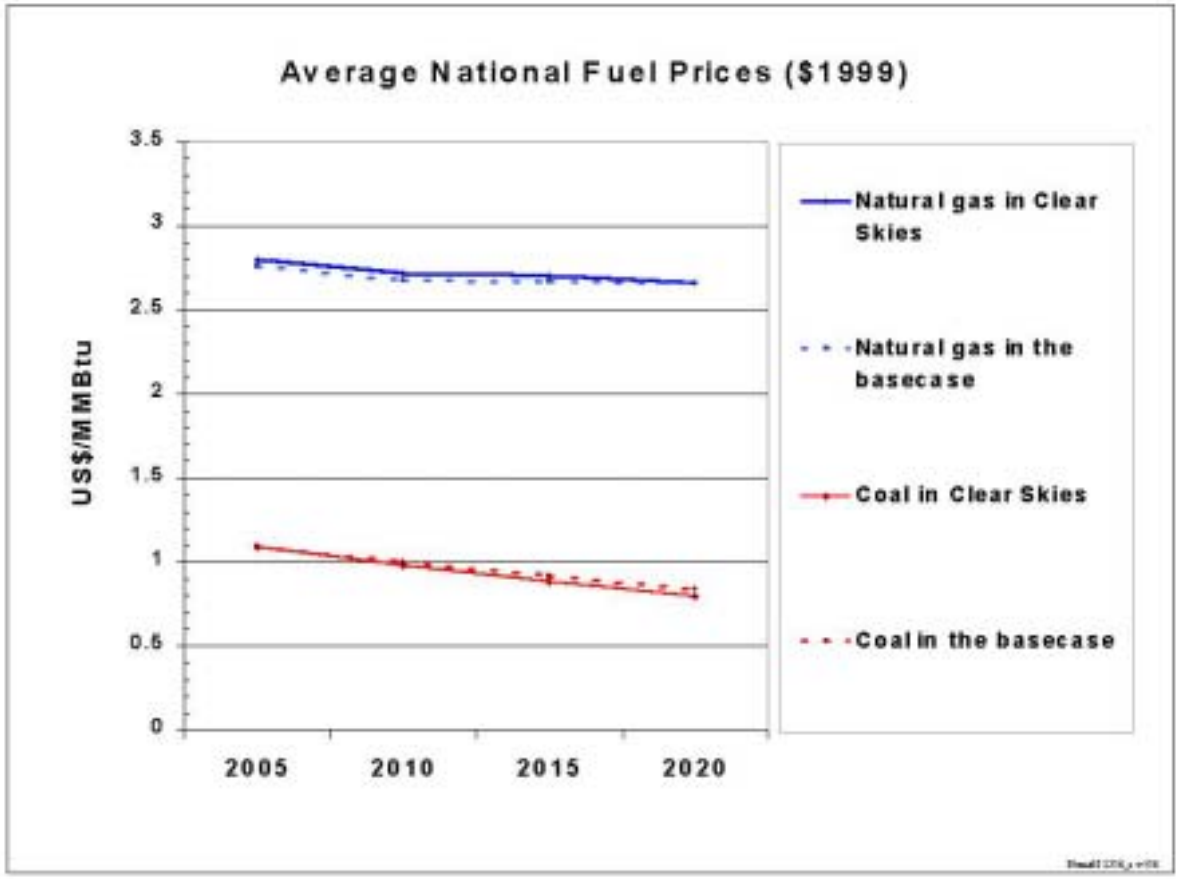
Production Cost and Electricity Price Forecast

- **The annual cost to meet Clear Skies rises over time**
- **Downward trend in retail electricity prices continues**





Impact on Fuel Prices



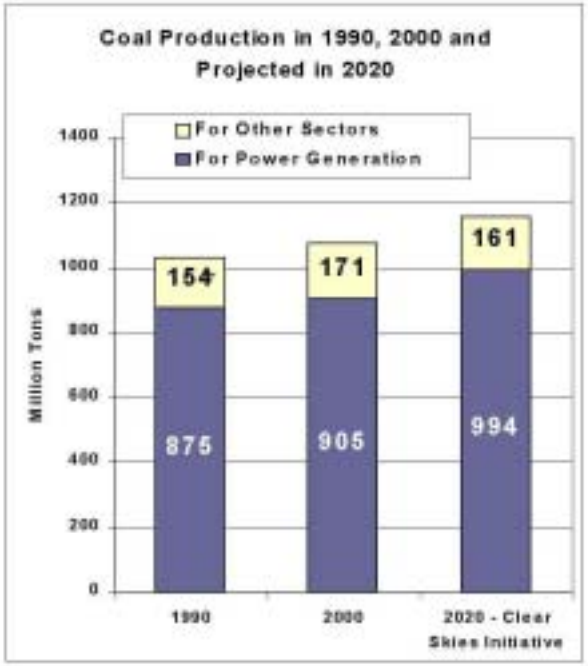
Note: the coal price represents an average across all twelve grades of coal in the model. The natural gas price is the Henry hub price, the coal price is the minemouth price. Average national fuel prices are EPA's estimates, EIA's modeling would likely show different fuel prices. Base case includes Title IV, the NOx SIP call, and state specific caps in CT, TX and MO. It does not include any potential future regulations to implement the current CAA.

Coal Production Grows with Some Regional Shifting

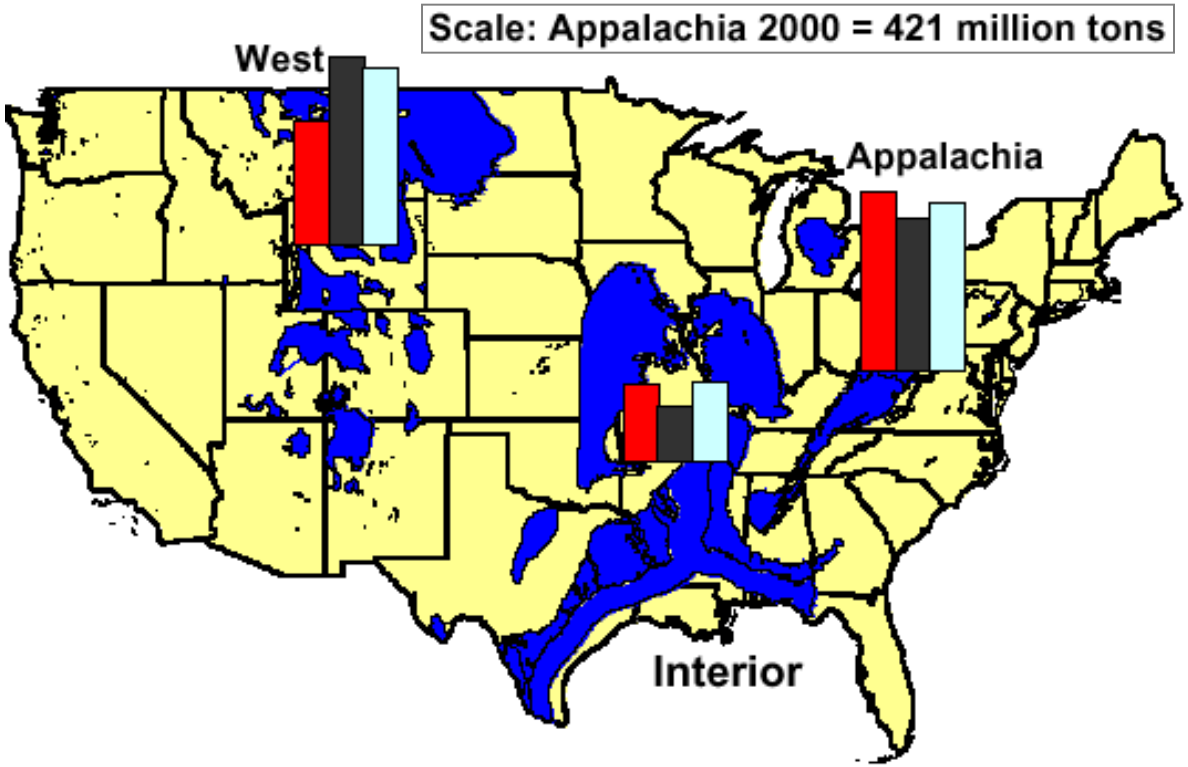
1990 National Coal Production

2000 National Coal Production

2020 National Coal Production under CSA



Note: In 1990, EIA did not report the coal produced for power generators. From 1998-2000, 85% of coal produced was for the power generation sector. For an estimate of coal produced for the power generation sector in 1990, EPA assumed the same percentage (85%).



Note: 2020 national coal production projections are EPA estimates from IPM.

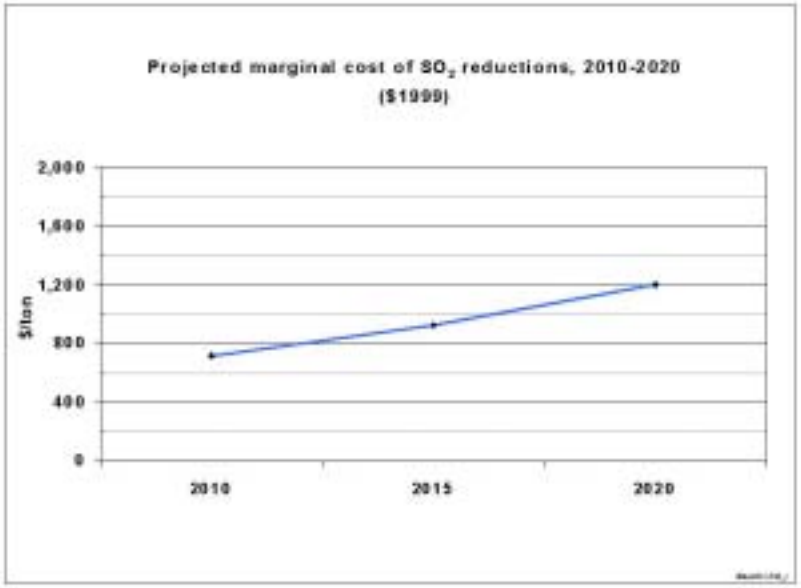
1990 data: Coal Industry Annual 1994, Table 4 (DOE/EIA-0584 (2000)).

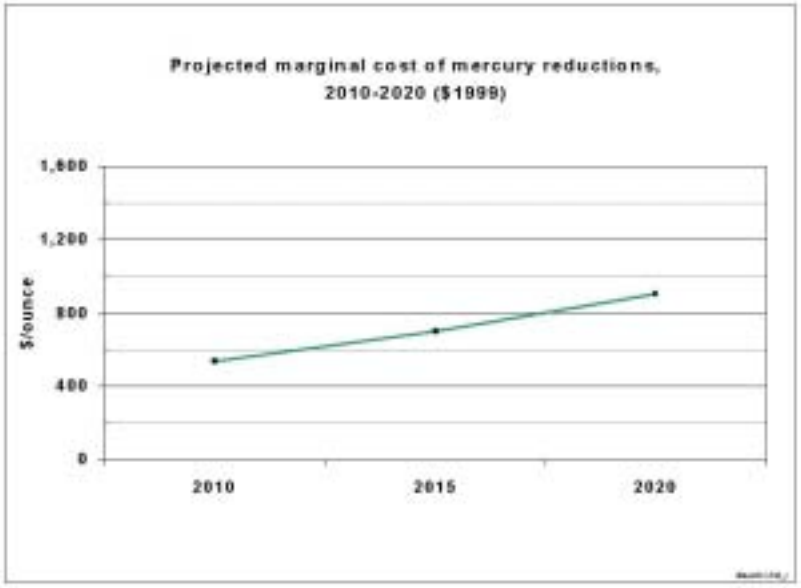
2000 data: Coal Industry Annual 2000, Table 4 and Table 63 (DOE/EIA-0584 (2000)), January, 2002.

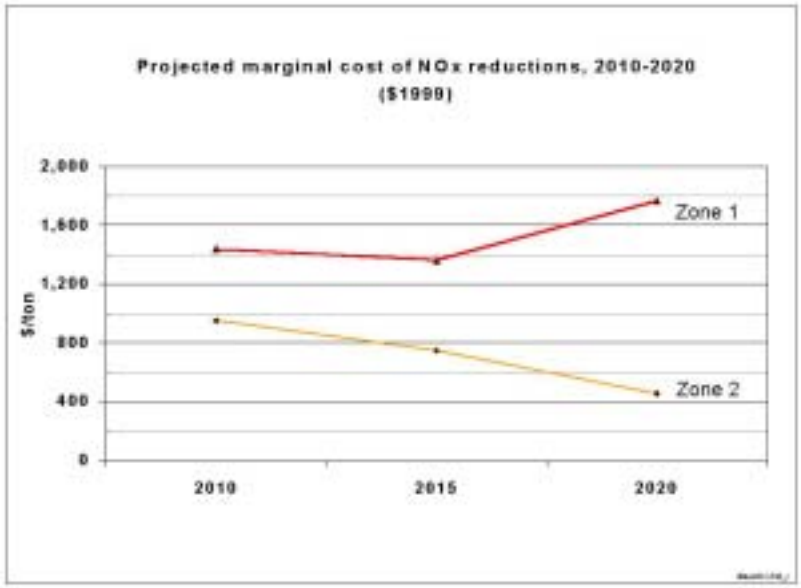
2020 production for the power generation sector: Derived from the Integrated Planning Model.

2020 production for other sectors: Derived from the National Energy Modeling System.

Projected Allowance Prices under Clear Skies







Note: under the Clear Skies Act, the marginal costs of SO_2 and NOx reductions are well below $2,000/ton and the marginal cost of mercury reductions are below $1,000/ounce.

The dollar value is the projected allowance price, representing the marginal cost (i.e., the cost of reducing the last ton) of emissions reductions. Marginal costs are based on modeling using IPM.

Distribution of Allowances under Clear Skies

- **The distribution of allowances under the Clear Skies Act occurs through the combination of an auction and an allocation:**
  - During the first year of the new trading program, 99% of the SO_2, NOx and mercury allowances would be allocated to affected units with an auction for the remaining 1%.
  - Each subsequent year, an additional 1% of the allowances for twenty years, and then an additional 2.5% thereafter, will be auctioned until eventually all the allowances are auctioned.

- **For the first twenty years of the trading programs, the majority of allowances are distributed *for free* via the allocation. Because of the time value of money, allowances allocated for these earlier years are generally more valuable in the allowance market than allowances allocated for later years.**
  - EPA analyzed the net present value (NPV) of the stream of allowances that would be distributed through 2030, as well as through 2061.

Despite the prevalence of the auction in the later years, EPA's analysis shows that the vast majority of the net present value of the allowances is distributed for free via allocation:

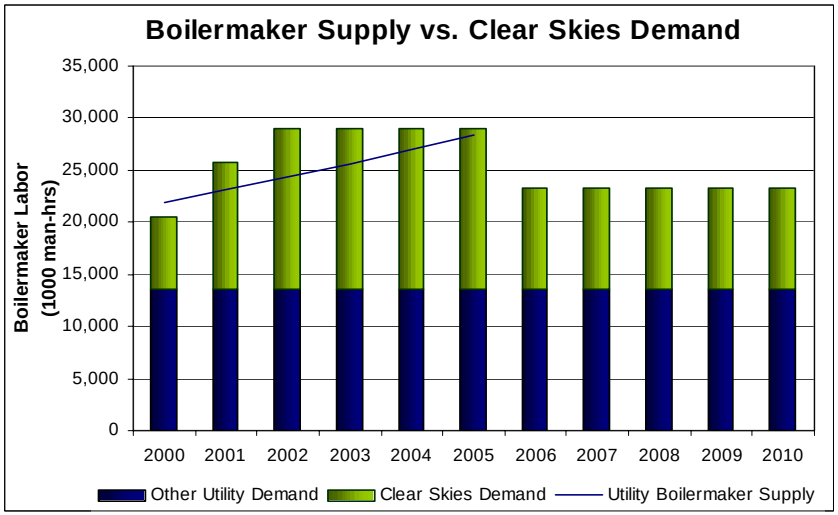
-- For the period between 2008/2010 and 2030, 90-92% of the total NPV is allocated.
-- For the period between 2008/2010 and 2061, approximately 80% of the total NPV is allocated.

Note: The net present value calculations are based on allowances prices in IPM.

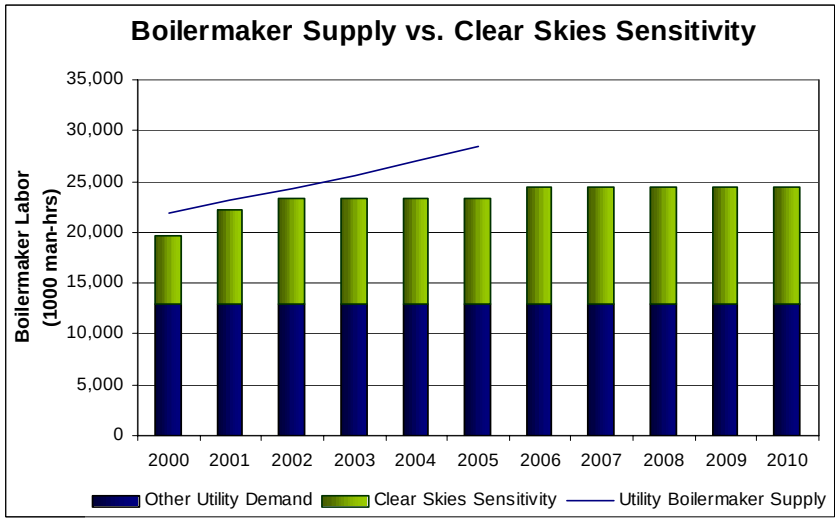
Engineering Analysis on Pollution Controls Shows Only One Limitation: Boilermaker Labor Before 2010

Labor Resources Required for Construction of Control Technologies

- Economic modeling projects 32 GW of scrubber builds by 2005 in addition to SCR for the NOx SIP Call.
- Boilermaker labor, used primarily by the electric utility industry, is expected to be limiting out to 2005.

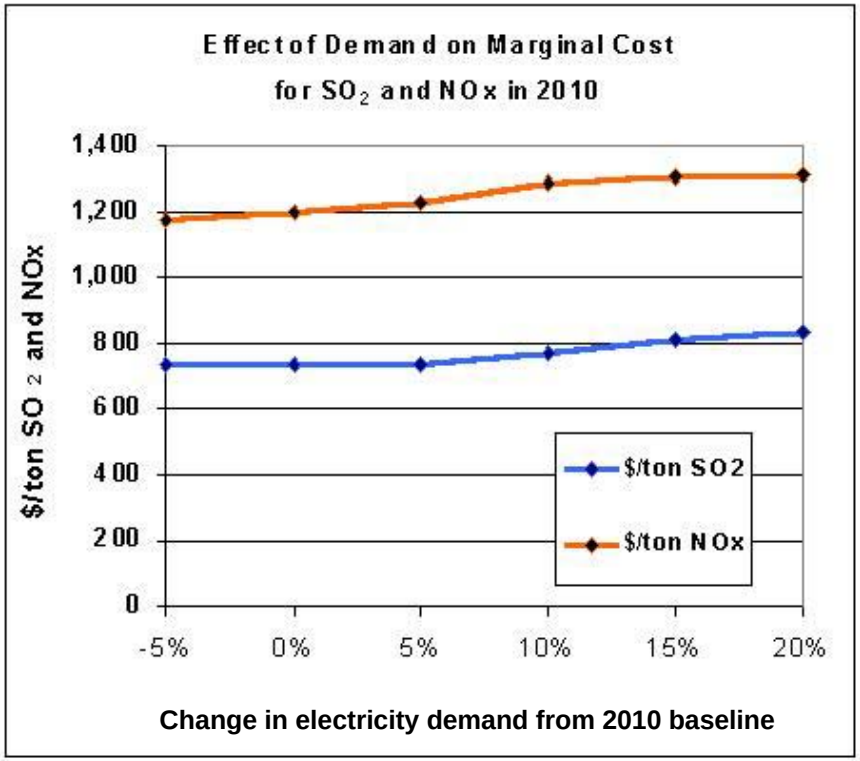


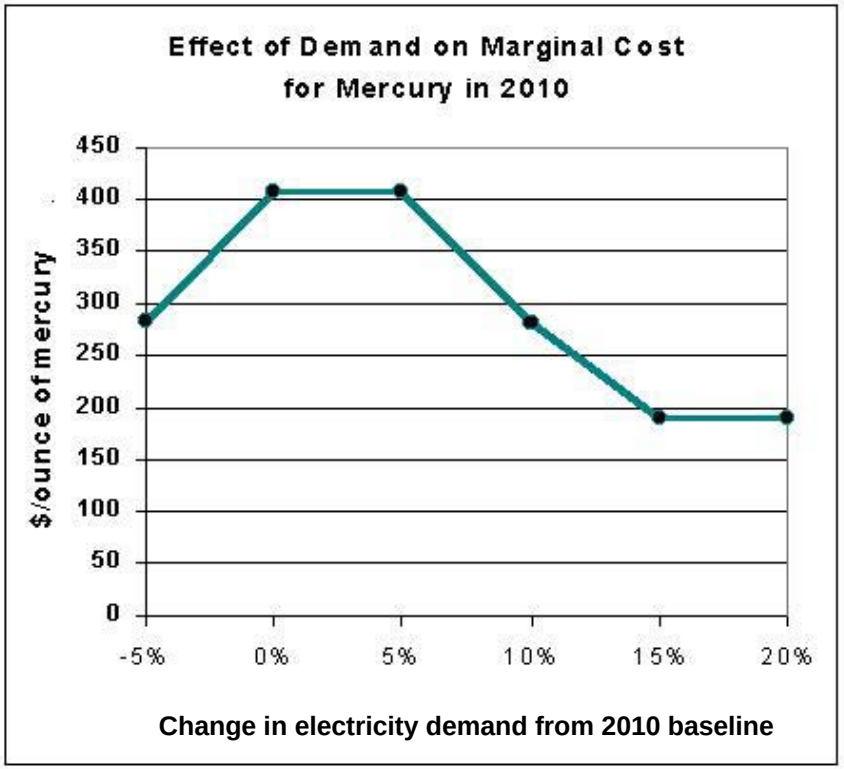
- Engineering analysis estimates 10 GW of the 32 GW of scrubbers could be completed by 2005.
- 22 GW of the projected 32 GW of scrubbers will likely be pushed back beyond 2005.



- General construction labor requirements for control technology installations are expected to be less than 0.3% of the current national labor pool of workers.

Sensitivity Analysis of Key Assumptions: Electricity Demand

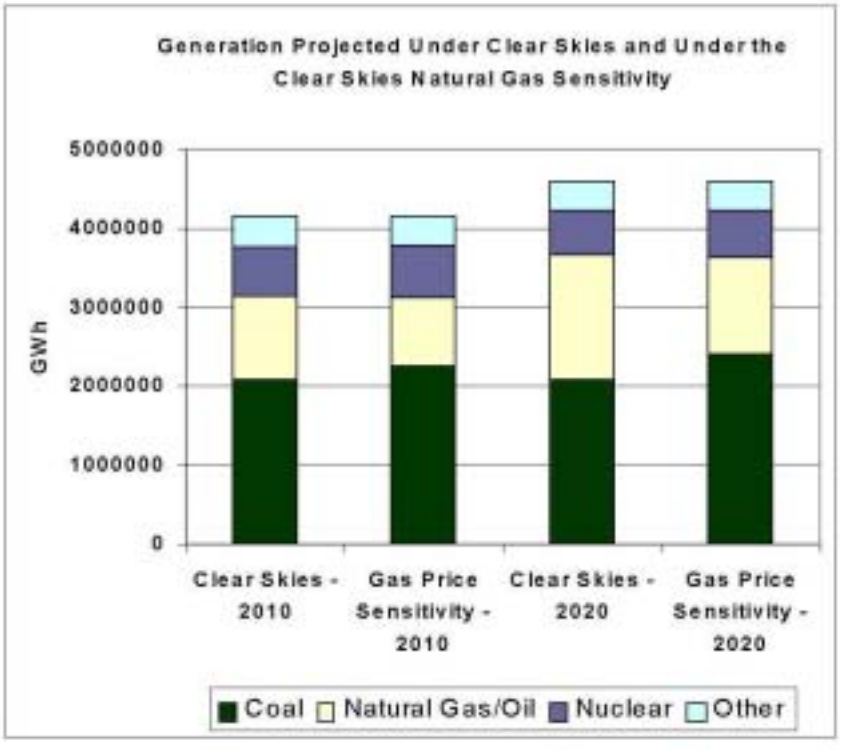


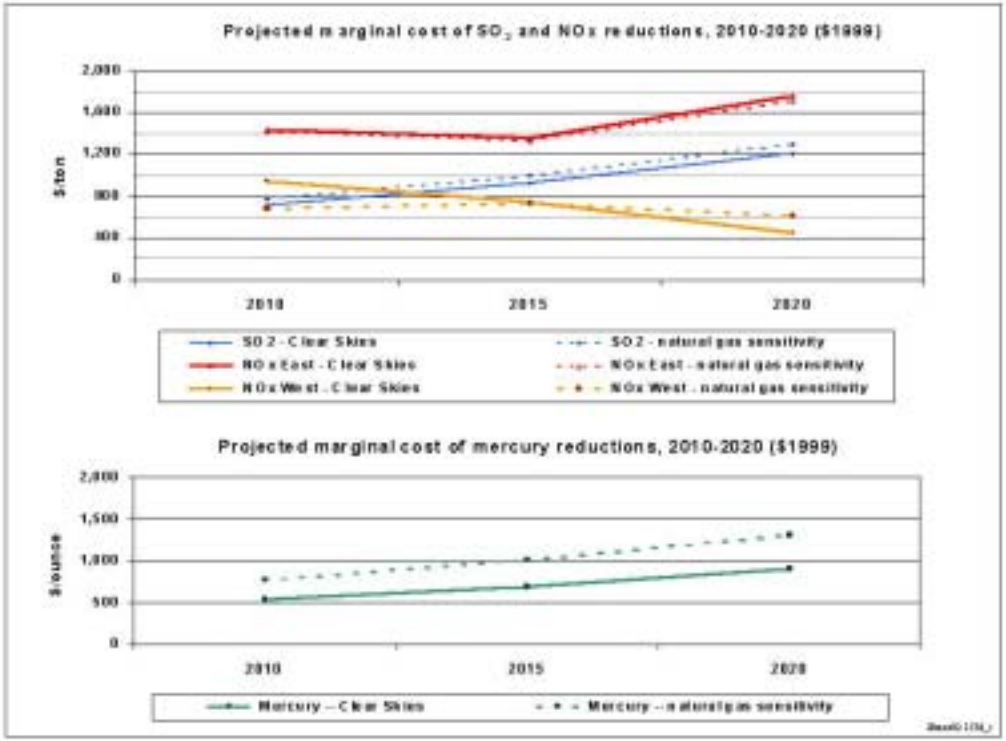


Note: The projected *emissions* under the Clear Skies Act in 2010 were used for this analysis. Analysis uses the Technology Retrofit and Updating Model (see Section G for a description).

Sensitivity Analysis of Key Assumptions: Natural Gas Prices

- **Shifting the natural gas supply curve in IPM up $0.80/MMBtu, or approximately 30%, results in the following impacts on generation and marginal costs.**

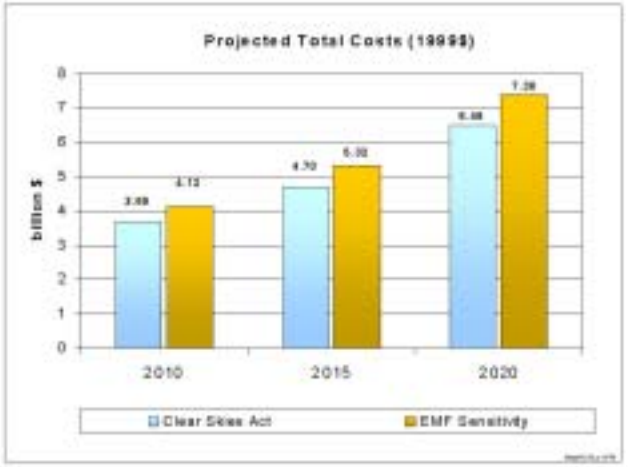


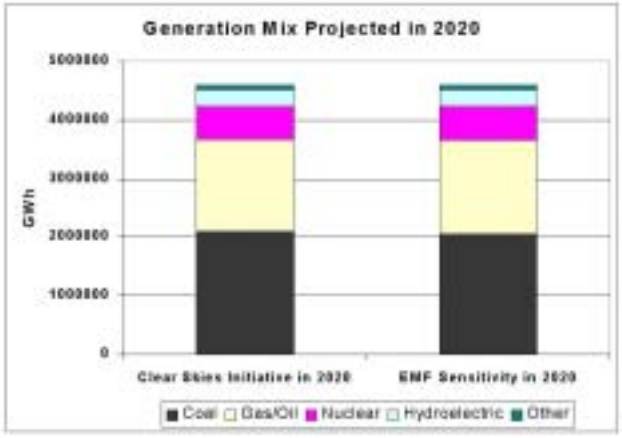


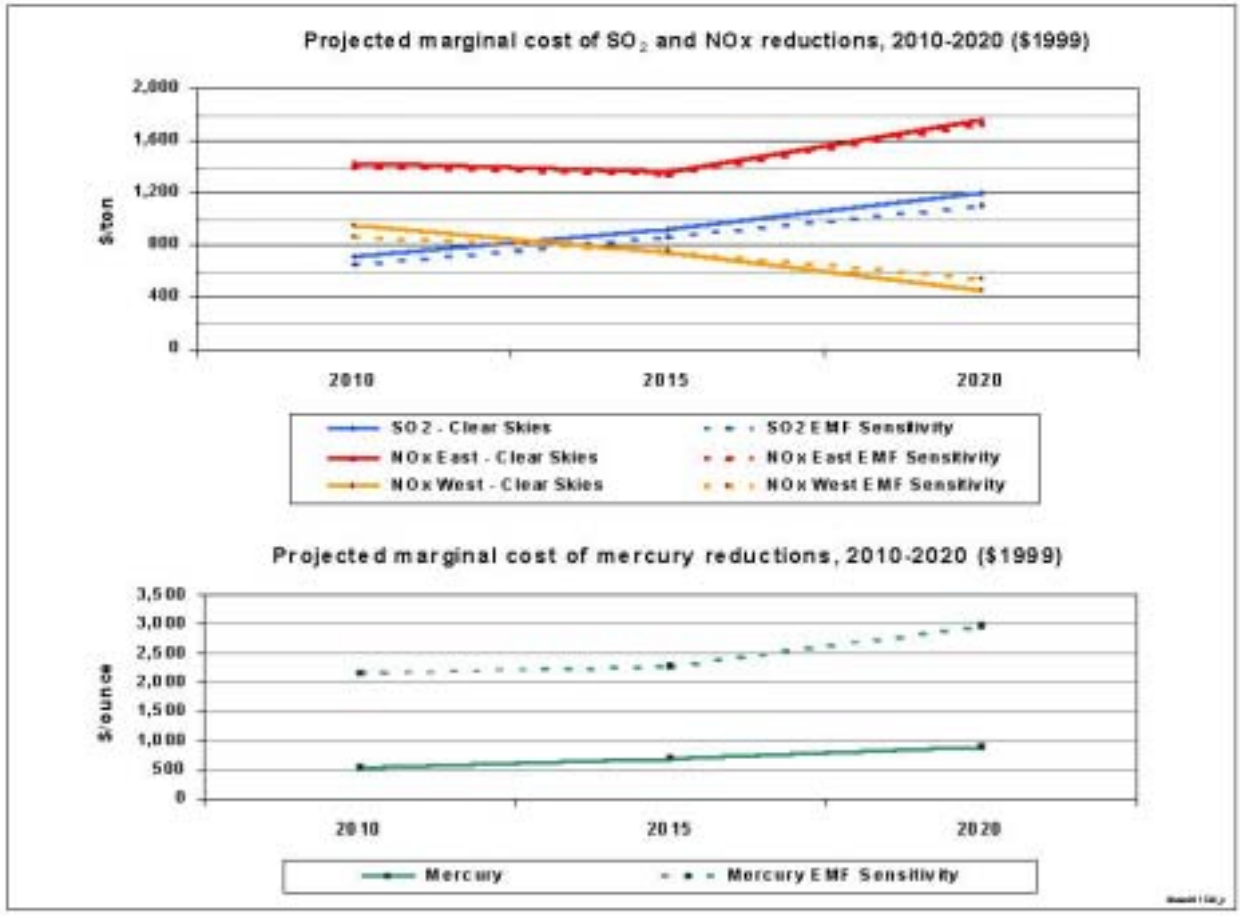
Note: For more information on the gas supply curves used in IPM see Chapter 8 and the Appendix to chapter 8 at http://www.epa.gov/airmarkets/epa-ipm/index.html#documentation,

Sensitivity Analysis of Key Assumptions: Mercury

- **Impacts of varying the assumptions regarding the mercury removal efficiency of a combination of SCR and FGD were examined using IPM; the results are compared to the Clear Skies policy with standard assumptions.**







Note: See the IPM documentation, chapter 5, table 5.7a (http://www.epa.gov/airmarkets/epa-ipm/index.html#documentation) for more information and 5.3.2 for a definition of "Alternative Emission Modification Factors (EMFs)". An EMF is the ratio of outlet mercury concentration to inlet mercury concentration; EMF's capture the mercury reductions attributable to different unit configurations and different configurations of SO_2, NOx, and particulate controls.

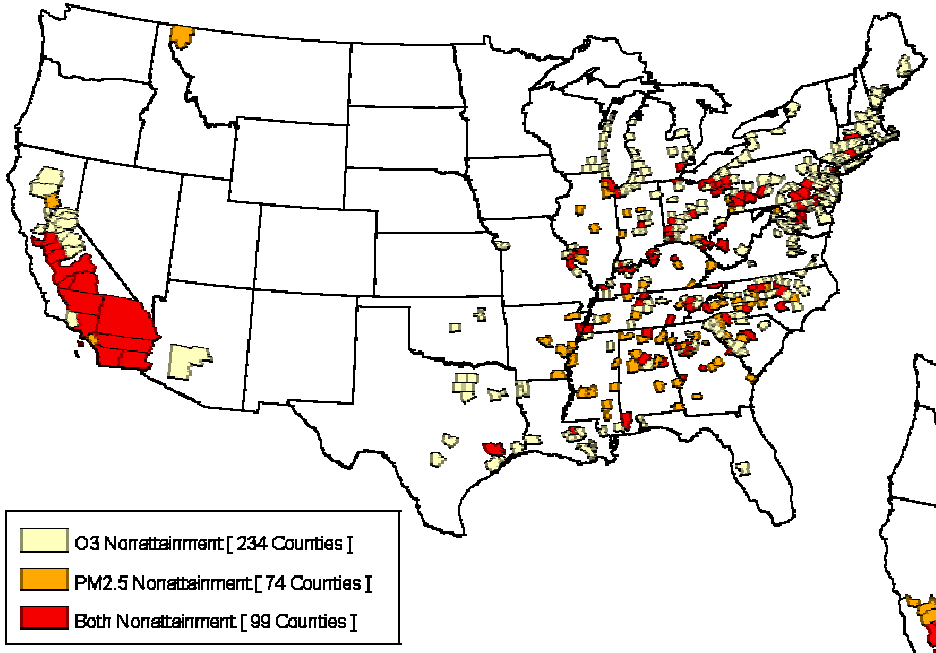
Sensitivity Analysis of Coal Plant Retirement

Scenario	Cumulative Retirements 2005-2020 (GW)	Average 2010 – 2020 U.S. Coal Power Plant Capacity Factor (%)
Base Case	0	82
Clear Skies (CS)	0	77
CS + Higher Capital/Financing Costs[1]	2.4	69
CS + Higher Coal Prices[2]	1.2	69
CS + Lower Gas Prices[3]	8.8	52
CS + Excess Capacity Build[4]	0	79

[1]Capital costs of environmental retrofits are doubled.
[2]Coal prices are maintained at the year 2000 level.
[3]Natural gas supply curves are scaled downward by 70 percent.
[4]In regions where capacity was being built in 2005, 20 percent excess is assumed to get built.
Note: 3P case for the 3P and all sensitivities assume SO_2 cap of 4.5 million tons in 2010 and 3.0 in 2018; NO_X cap of 2.1 million tons in 2008 and 1.7 in 2018; Hg cap of 26 tons in 2010 and 15 tons in 2018.

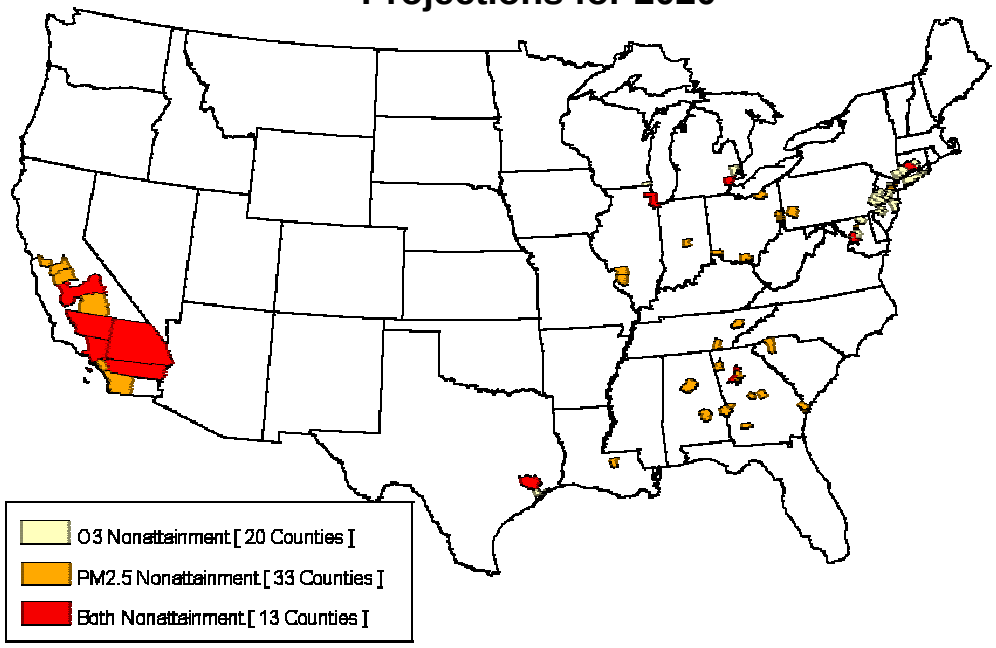
Clear Skies Delivers Extensive Health Benefits and Widespread Attainment with Standards for $PM_{2.5}$ and Ozone

Current Data



Currently, hundreds of counties fail to meet national standards.

Clear Skies and Existing Programs Projections for 2020



- Under Clear Skies, more than 20 million additional people would be breathing air that meets the national standards in 2020.
- Air pollution in remaining counties would improve, facilitating local attainment planning.

Note: To permit comparisons among various analyses, the air quality data were the most complete and recently available as of mid-2001 (1997-1999 ozone monitoring data and 1999-2000 $PM_{2.5}$ data). More complete and recent air quality data for ozone and fine particles (1999-2001 data) is expected to vary slightly from what is presented here.

Health and Visibility Benefits Are Substantial

- **Clear Skies does better than CAA over the next decade – added reduction of 35 million tons of SO_2 and NO_x.**

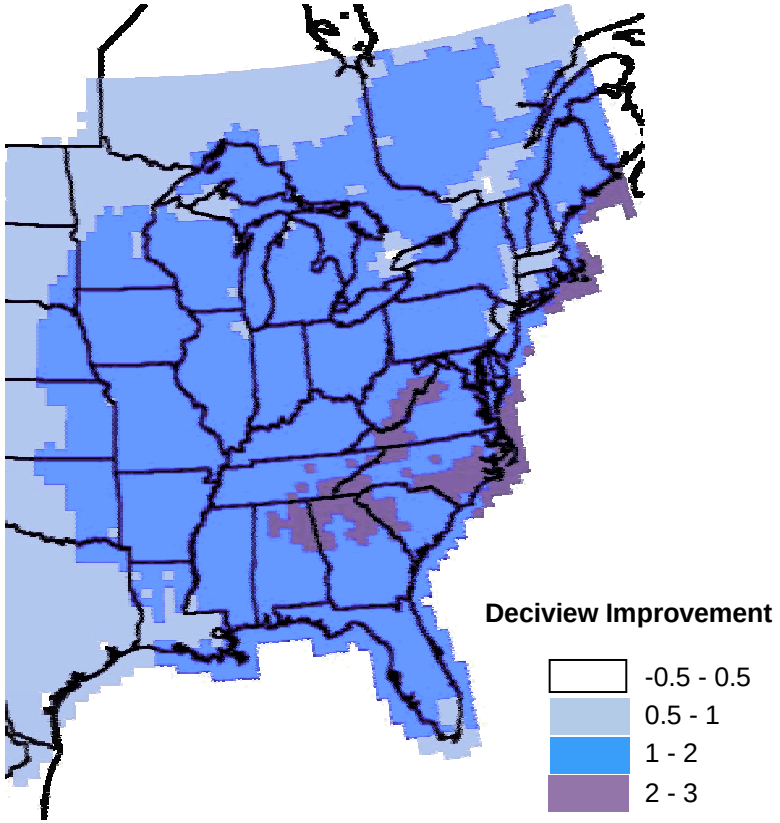
- **Health and visibility benefits, that we can estimate, grow to about $96 billion annually by 2020.**
  - Most of the benefit results from prolonging lives – Clear Skies prevents about 12,000 premature deaths annually
  - Prevents over 7,000 cases of chronic bronchitis, almost 12,000 hospitalizations and emergency room visits for lung and heart problems, and 15 million fewer days of respiratory illnesses and symptoms, including asthma attacks
  - $93 billion of the benefits result from protecting the public's health*
  - $3 billion of the benefits are from improving visibility in Western and Southern parks
  - $15 in benefits ("monetized") for every dollar invested for a cleaner environment
  - There are more health and environmental benefits that aren't currently monetized

- **Recent study by Resources for the Future corroborates findings**

*An alternative estimate projects $ 11 billion of benefits annually with 7,200 avoided premature deaths and is based on the use of short-term concentration/response functions for particles and a different approach to valuation of health effects damage.

Clear Skies Improves and Protects Visibility

Visibility change in 2020 under Clear Skies compared to existing programs



(A positive change in deciviews is an improvement in visibility; a negative change in deciviews is a decrease in visibility.)

Note: The western U.S. is not shown in this map because the emissions reductions expected from the WRAP have not yet been included in the air quality modeling analysis.

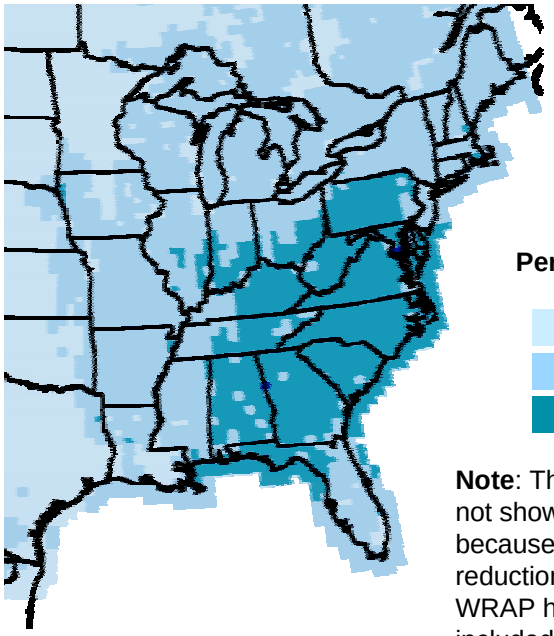
- Clear Skies would significantly improve visibility over much of the East and Midwest, especially in Shenandoah and Great Smoky Mountain National Parks, where visibility has been deteriorating

- Clear Skies will honor the Western Regional Air Partnership emissions reductions, allowing future growth in the West to occur without degrading visibility

The benefits of improving visibility in select Southern and Western National Parks and Wilderness Areas, including Great Smoky, Shenandoah, and Grand Canyon National Parks, would total $3 billion annually by 2020

Clear Skies Reduces Acid Deposition

Percent Change in Sulfur Deposition in 2020 under Clear Skies compared to existing programs

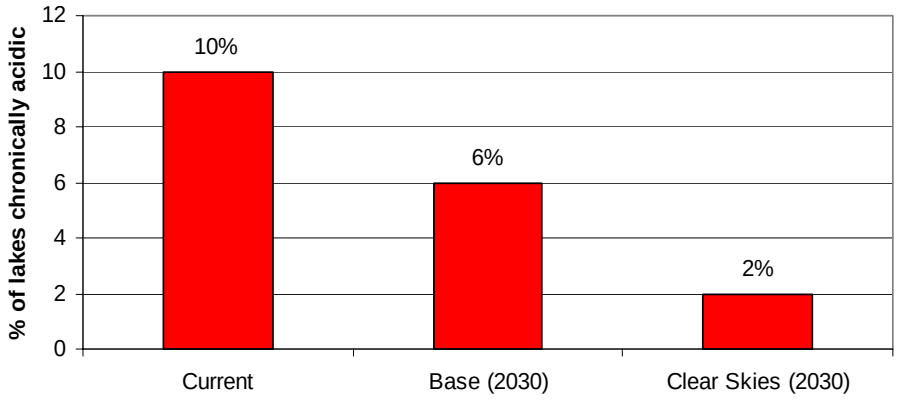


Note: The western U.S. is not shown in this map because the emissions reductions expected from the WRAP have not yet been included in the air quality modeling analysis.

- Lakes in the Northeast have already begun recovering from acidification
- Clear Skies would accelerate that trend, virtually eliminating chronic acidity in Northeastern and Adirondack lakes by 2030
  - Clear Skies would also prevent further acidification of Southeastern streams

- Clear Skies would reduce sulfur deposition--a primary component of acid rain-- to sensitive ecosystems by up to 60% throughout the mid-Atlantic and Southeastern U.S.

Fewer Northeastern lakes would be acidic under Clear Skies compared to existing programs



Clear Skies Reduces Nitrogen Deposition

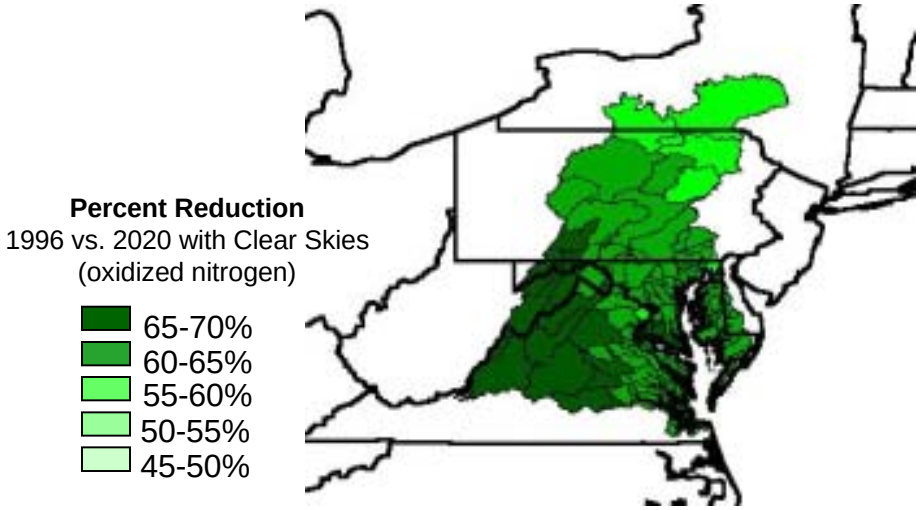
Percent Change in Nitrogen Deposition in 2020 under Clear Skies compared to existing programs

- Clear Skies would significantly reduce nitrogen deposition, the other key component of acid rain and a significant source of nitrogen to coastal waters:
  - 30-60% in areas of the Southeast, including Great Smoky Mountain National Park and coastal waters of North Carolina, Georgia, and Florida
  - up to 30% in the Northeast, including in the the Adirondack and Catskill Mountains

- In the West, Clear Skies would prevent further degradation of air quality and visibility even as economic growth continues

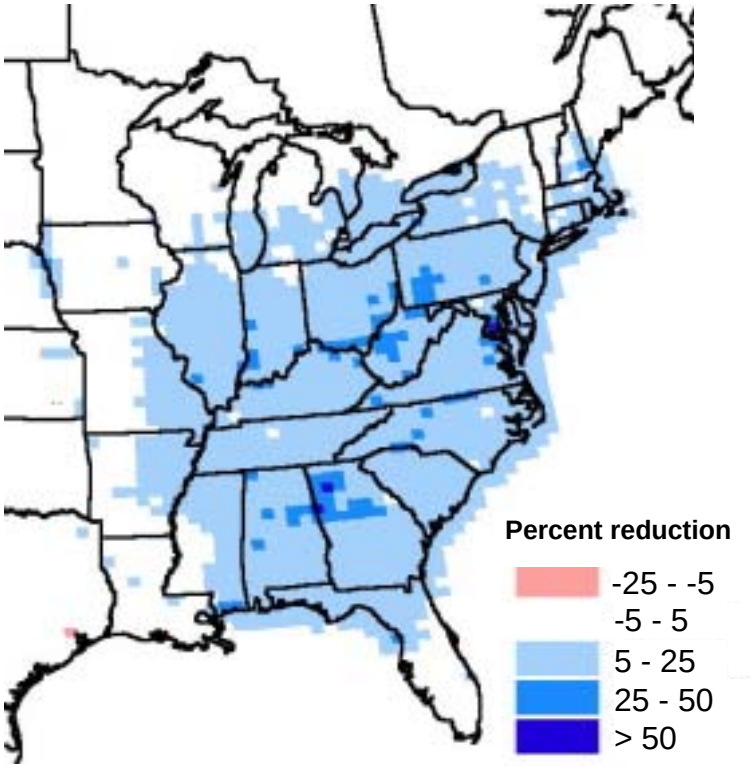
- Clear Skies would reduce the amount of nitrogen entering the Chesapeake Bay by 10 million pounds annually by 2020

Percent Change in Summertime Nitrogen Deposition to the Chesapeake Bay watershed in 2020 under Clear Skies compared to current levels



Clear Skies Reduces Mercury Deposition

Percent change in mercury deposition in 2020 under Clear Skies compared to existing programs



Notes:
-- The small increase in mercury deposition at one location is attributable to a single facility mistakenly omitted from the Clear Skies mercury cap in the IPM analysis. Were this facility included in the cap, this increase would not have occurred.
-- The western U.S. is not shown in this map because the emissions reductions expected from the WRAP have not yet been included in the air quality modeling analysis.

- Mercury deposition is a significant source of contamination in many rivers, lakes, streams, and coastal waters
  - currently 44 states have issued fish advisories due to mercury contamination
- Clear Skies would reduce mercury deposition to lakes, rivers, and coastal waters up to 25% across much of the East:
  - larger reductions--up to 50%--would occur along the Ohio River and in portions of the mid-Atlantic, northern Georgia, and Alabama

Conclusions

- **Clear Skies addresses air pollution from the power sector in a serious, yet flexible way.**
  - **Phases in control under a cap and trade approach**
- **Costs and other impacts are manageable.**
- **Benefits begin immediately, and are substantial:**
  - **Air quality gains**
  - **Health and visibility benefits**
  - **Environmental improvements**
- **Clear Skies provides cleaner air than the existing CAA through 2012 and is more cost-effective in cutting air pollution.**
- **Benefits of Clear Skies are a bargain at the cost we pay.**


For Additional Information, Visit
Clear Skies Website
www.epa.gov/clearskies